

OPTICAL LABEL READER AND DECODER

This is a continuation of co-pending patent application Ser. No. 716,534, filed Mar. 27, 1968.

BACKGROUND OF THE INVENTION

This invention relates generally to coded labels, coded information reading, and automatic coded information processing, and relates more particularly to coded label reading optics and coded label information signal processing means.

In many enterprises, large numbers of items must be handled during a given time period. For example, grocery stores, post offices, or parts supply warehouses must handle large volumes of items which must be properly handled so that the recipient would be correctly billed and/or the item would be inventoried. In many instances, this could be done by hand or manually. In other instances, this handling could be done automatically by the use of coded tags or the like, fastened to the items, which tags could be read by an appropriate reader. It could also be possible to place a code marker or information at a predetermined location on the item so that the information would always be at a predetermined location and/or in a predetermined orientation as the information was fed past a reader station. Furthermore, by proper selection of the coded medium and the particular reading technique used, it could be possible to reduce background noise error signals which could otherwise affect the accuracy of the processing.

SUMMARY OF THE INVENTION

Accordingly, an object of this invention is to provide means and methods for reading coded information which has the advantages of being substantially independent of the orientation and position of the coded information.

Another object is to provide means and methods for automatically reading a coded medium on an object so that only the coded information on the medium is processed.

Still another object is to provide improvements in a coded label, label reading optics, and the code processing circuitry in a label reading system of the above type.

Other objects of this invention can be attained by providing a coded label format of contrasting bar markings which includes a leader portion at least one word long, and a unique preamble word followed by data words with each word being started by a sync marking and ended by a reset marking that contrast with one another. The advantages of this format are that the label can be read from only one direction to produce valid information signals and that the reader and the decoder are synchronized with every word.

A label reader is positioned under a counter top so that when an object having a coded label fastened thereto is placed upon a window associated with the reader, the reader optics scans the label with a bar light beam that scans or sweeps radially inward through a point on the window. In addition, the beam is continually rotated about the point by the reader optics so that each subsequent scan through the point occurs from a slightly different radial angle than the previous scan throughout the entire 360° of rotation. Thus, when the bar light beam scans the label, the label reader generates information signals corresponding to the coded information. As a result, the coded label can be read independently of its orientation or position when substantially parallel to a focal plane.

A decoder, which is coupled to receive information signals produced when the label is scanned, is reset in an initial condition by the leader and is then subsequently enabled to process the data words only after the signals associated with the unique preamble are received. In processing the information, the reset signal at the end of each word must occur during a predetermined time period following the sync signal at the beginning of each word or else the decoder will not process the data word information and will be returned to its initial condition after a predetermined time delay so that the label can again be read. In addition, before the data words are displayed or otherwise further processed, the label is read a

second time and the data words of the second reading compared with the corresponding data words stored during the previous reading. As a result, only valid, complete, and verified data will be processed and displayed. In addition, data words can be inserted into the decoder manually, and data words that have been already read and stored can be deleted by manual operation of the operator.

Other objects, features and advantages of this invention will become apparent upon reading the following detailed description and referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of one utilization of an embodiment of the invention in a grocery checkout stand, where items placed on a window located in the counter top are read, the information decoded, and then displayed;

FIG. 2 is a graphical illustration of a label with a preferred code format, including a leader, a preamble word, and a series of data words coded by a series of contrasting bar markings;

FIGS. 3a through 3e are schematics of an optical reader illustrating the rotating bar scanner optics and the resulting beam scanning operation across the window;

FIG. 4 is a block diagram illustrating the optical reader, the decoder, and the processor;

FIG. 5 is a timing chart showing the relationship between the signals generated by the optical reader and the signals generated by the decoder of FIG. 4 when the label of FIG. 2 is read;

FIG. 6a is a schematic diagram of a portion of the data verification and data complete circuit, the read enable switch, and the delete switch of FIG. 4;

FIG. 6b is a schematic diagram of the signal conditioner of FIG. 4;

FIG. 7 is a schematic diagram of the sampling sequence generator of FIG. 4, illustrating a ramp signal generator and five threshold detector circuits;

FIG. 8 is a timing chart, illustrating the wave-forms of signals generated by the threshold detectors circuit in the read sequence generator of FIG. 7;

FIG. 9 is a schematic diagram of the buffer storage, the preamble recognizer, the digit counter, and the transfer generator of FIG. 4;

FIG. 10 is a schematic of a decimal digit storage stage in the data digit storage of FIG. 4; and

FIG. 11 is a block diagram of an EXCLUSIVE OR circuit in the data verification and data complete circuit of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the details of an embodiment which is incorporated in a grocery checkout stand, FIG. 1 illustrates a checkout stand 11 having a top surface 12 which receives items of merchandise 13 placed thereon. Each item of merchandise 13 has at least one coded label 14 fastened to a surface which is flat enough so that the entire label surface is within a predetermined depth of focus or field when placed substantially parallel to the top surface 12. As the merchandise 13 is passed over a transparent window 15 or aperture of an optical reader 17 located within the checkout stand, the labels 14 which are face down are optically scanned so that coded information contained thereon is converted to electrical signals which are fed to a decoder 20 within a range of data rates. The decoder 20 processes the signals to determine if the coded information is valid and processes it into a decimal format so that it can be processed such as displayed on a digital display 22 for the benefit of a cashier and a customer. It should, of course, be understood that the coded information could also be further processed to operate as an inventory routing system.

Referring now to the label 14 in more detail, one label format as illustrated in FIG. 2 can include a flat, rectangular piece of material having an adhesive backing (not shown) which is operable to adhere or fasten the label to a surface of